UNITED STATES PATENT APPLICATION

FOR

SYSTEM AND METHOD FOR SENDING VOICE DATA TO AND FROM A MOBILE DEVICE IN A WIRELESS NETWORK

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<u>S P E C I F I C A T I O N</u>

<u>TITLE OF INVENTION</u>

SYSTEM AND METHOD FOR SENDING DATA TO A MOBILE DEVICE IN A WIRELESS NETWORK

[0001]   This application claims priority based on provisional application serial no. 60/443,139, entitled "System and Method for Sending Voice Data to and from a Mobile Device in a Wireless Network" by Hilton Hung filed on January 27, 2003.

<u>FIELD OF THE INVENTION</u>

[0002]   The present invention relates to a wireless communication system. More particularly, the present invention is related to sending constant time data to a non-static device coupled to a wireless network.

<u>BACKGROUND</u>

[0003]   In some wireless networks, an access point (AP) can be coupled to a variety of wireless network devices. Typically, a wireless network can allow a mobile device to send and receive data as it moves through coverage zones of the individual access points. In some cases, the access point sends and/or receives constant-time dependent data, such as voice data to or from a wireless network device in its coverage zone. Typically, the wireless network devices contend for a

time to send this data, and as such, data may be lost due to long contention waits or collisions.

[0004]   A similar problem exists when the access point must send data to several wireless network devices. Each transmission of data to a specific wireless network device requires an overhead by the access point, thus slowing the overall time to reach all the wireless network devices with such constant time data.

[0005]   At the moment, the 802.11e wireless standard provides mechanisms that help this problem. The first mechanism, designated as enhanced distributed coordination function (EDCF), is based on differentiating priorities at which traffic is to be delivered. This differentiation is achieved by varying the amount of time a station would sense the channel to be idle, the length of the contention window during a backoff, or the duration a station may transmit once it has the channel access.

[0006]   Another mechanism allows for contention-free, as well as contention based, access to the wireless medium. This is known as the hybrid coordination function (HCF). A solution employing HCF allows for the reservation of transmission opportunities with a hybrid coordinator (HC). Based on the particular requirements, a wireless network device requests the HC for transmission opportunities – both for its own transmissions as well as transmissions from the HC to itself. The request itself may be initiated within the media access control (MAC) functionality of the wireless network device. Or, this

may be requested by a station management functionality of the wireless network device.

[0007]   The HC, based on an admission control policy, either accepts or rejects the request. If the request is accepted, it schedules transmission opportunities for the wireless network device. For transmissions for the wireless network device, the HC polls based on parameters supplied by the wireless network device.

[0008]   Neither of these options is entirely satisfactory. The EDCF solution provides only statistically prioritized access to the medium, but does not guarantee latency for any packet stream. The HCF solution offers more predictable overhead, but requires the overhead of polling each wireless network device, as well as an additional layer of complexity in implementing the packet scheduler that is implied, but not defined, by the specification.

SUMMARY

[0009]   A system for wirelessly transmitting time constant data under a

wireless protocol is contemplated. A access point device initiates a reservation of

time under a protocol. The transmitting device then downloads the time constant

data to the remote devices. This can take place as individual transmissions or a

single unicast transmission of one block containing all the data for the remote

wireless device(s). The access point polls each remote wireless device for

constant time data to be sent to the remainder of the network. At the conclusion,

the access point gives up the reservation so as to enable the remote wireless

devices to use the access point for other forms of data traffic.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010]   The accompanying drawings, which are incorporated into and constitute a

part of this specification, illustrate one or more embodiments of the present invention

and, together with the detailed description, serve to explain the principles and

implementations of the invention.

[0011]   In the drawings:

Figure 1 is a network diagram of wireless network that enables constant bit

rate data delivery, according to the invention.

Figure 2 is a timing diagram detailing an interaction that may be used in the

network detailed in Figure 1.

Figure 3 is a timing diagram detailing an interaction between the access

point and the wireless network device for downlinking data to the wireless

network devices.

Figure 4 is a timing diagram detailing an exemplary combination of

download and upload between the access point and the wireless network devices.

At a time t6, a last packet is received.

DETAILED DESCRIPTION

[0012]   Embodiments of the present invention are described herein in the context of a System And Method For Sending Voice Data To and From A Mobile Device In A Wireless Network. Those of ordinary skill in the art will realize that the following detailed description of the present invention is illustrative only and is not intended to be in any way limiting. Other embodiments of the present invention will readily suggest themselves to such skilled persons having the benefit of this disclosure. Reference will now be made in detail to implementations of the present invention as illustrated in the accompanying drawings. The same reference indicators will be used throughout the drawings and the following detailed description to refer to the same or like parts.

[0013]   In the interest of clarity, not all of the routine features of the implementations described herein are shown and described. It will, of course, be appreciated that in the development of any such actual implementation, numerous implementation-specific decisions must be made in order to achieve the developer's specific goals, such as compliance with application- and business-related constraints, and that these specific goals will vary from one implementation to another and from one developer to another. Moreover, it will be appreciated that such a development effort might be complex and time-consuming, but would nevertheless be a routine undertaking of engineering for those of ordinary skill in the art having the benefit of this disclosure.

[0014]   In accordance with the present invention, the components, process

steps, and/or data structures may be implemented using various types of digital

systems, including hardware, software, or any combination thereof. In addition,

those of ordinary skill in the art will recognize that devices of a less general

purpose nature, such as hardwired devices, field programmable gate arrays

(FPGAs), application specific integrated circuits (ASICs), or the like, may also be

used without departing from the scope and spirit of the inventive concepts

disclosed herein.

[0015]   Figure 1 is a network diagram of wireless network that enables

constant bit rate data delivery, according to the invention. A wireless network 10

contains an access point 12, and one or more wireless network devices, such as

wireless network device 14, and wireless network device 16. The access point 12

contains a portion 18 that enables the access point 12 to deliver constant bit rate

data to the wireless network devices 14 and 16.

[0016]   This diagram is explained in context of the 802.11 wireless protocol.

However, it should be understood that this is not limiting, and that any wireless

protocol may be used herein. Under the 802.11 protocol, the access point can

deliver data to any wireless network device in its zone. Immediately following

such a broadcast, a period of down time is enforced in the network, to allow for

the receiving device to send an acknowledgement of the message.

[0017]   After the acknowledgement, another time window is imposed on the

devices to avoid collisions. This is known as the distributed coordination function

(DCF) interframe space (DIFS). In this time period, no transmissions by devices in contact with the access point are allowed.

[0018]   In the context of the present invention, the access point takes advantage of the DIFS to implement a constant bit data transmission scheme. Prior to the expiration of the DIFS, the access point broadcasts a signal that each of the wireless network devices expecting timed data is attuned for. This signal signifies one or more actions in this disclosure.

[0019]   In one embodiment, the signal signifies to the wireless network devices expecting timed data that a block of such timed data is forthcoming from the access point to the various wireless network devices. In the signal, or after such signal, the access point transmits the timed data flowing to the wireless network devices in a single transmission block.

[0020]   In our example, assume the wireless network devices 14 and 16 are operating in a voice transmission mode, or another mode that uses such timed data. When the access point signals the beginning of a timed data frame, the wireless network devices 14 and 16 know that the next transmission is such timed data.

[0021]   In one example, the timed data is sent in a single block transmission. In this manner the wireless network devices 14 and 16 both receive the data and process the data block accordingly. In one possible scheme, the wireless network device 14, upon registration, is told by the access point that it shall have the first portion of data in a block. In the same manner, when the wireless network device

16 registers with the access point, the access point indicates that the data directed

to the wireless network device 16 is contained in the second portion of the block.

In this manner, a single block of timed data may be multicast to the various

wireless network devices, and the remote wireless network devices may process

the block accordingly. This optimizes the flow of data to the wireless network

devices, since multiple transmissions need not be performed.

[0022]   In another aspect, the upcoming data may be polled from the various

wireless network devices. One way to accomplish this is to poll each wireless

network device for its uplink data to be directed to the network 10. Accordingly,

during this period, the access point first polls the wireless network device 14 for

the upgoing data. At the conclusion of this transmission, the access point polls the

wireless network device 16 for its upgoing data. In this manner, all upgoing timed

data may be extracted.

[0023]   The size of the upgoing transmissions can be easily managed, since

this is typically time bit constant data. Thus, the access point can easily scale a

frame to fit the expected traffic.

[0024]   In performing these functions, the access point may reserve a block

of time through network protocol. This can define a frame for the timed data bit

transfer to take place. In one embodiment, the doweled block transmission, as

described above, and the polled upload are coordinated together. Or, these

functions can be performed separately. In this manner, a timing reference may be

supplied by the access point to the associated wireless network device to define

slots for the downlink and uplink of such constant data bit transfers.

[0025]   Figure 2 is a timing diagram detailing an interaction that may be

used in the network detailed in Figure 1. At a time t1, a last packet is received

from some data source. At a time t2, prior to the expiration of the DIFS, the

access point produces a polling signal to the first wireless network device,

initiating the upload of the data traveling to the network. This sequence continues

for each wireless network device that is transmitting voice data to the network.

[0026]   Figure 3 is a timing diagram detailing an interaction between the

access point and the wireless network device for downlinking data to the wireless

network devices. At a time t3, a last packet is received. At a time t4, prior to the

expiration of the DIFS, the access point produces signal to the wireless network

devices, telling them to expect a block download of data. This signal inhibits any

wireless network devices within the zone to send data, and may be used to reset

any standoff characteristics of coupled wireless network devices. The data stream

starts at a time t5. As said before, the appropriate wireless network device will

pull the data from the block that is intended for it.

[0027]   In another embodiment, a variation of the polling method of Figure 2

may be used to download data. In this manner, the individual wireless network

devices are sequentially polled to expect a download of data.

[0028]   Figure 4 is a timing diagram detailing an exemplary combination of

download and upload between the access point and the wireless network devices.

At a time t6, a last packet is received. At a time t7, prior to the expiration of the DIFS, the access point produces signal to the wireless network devices, telling them to expect a block download of data. Also, this signal delineates a frame in which the access point reserves, thus inhibiting collision from the rest of the network. Within this frame, the signals for the download data and upload data are depicted.

[0029]   In one example, if the requested frame is shorter than expected, the access point can fill the frame with non-constant time bit data. When the filler data is through, the process can repeat. This can be accomplished in an efficient manner, since the access point simply adjusts for any jitter through the sending of the first signal delineating the start of a constant time bit data frame.

[0030]   Thus, a System And Method For Sending Voice Data To and From A Mobile Device In A Wireless Network. is described and illustrated. Those skilled in the art will recognize that many modifications and variations of the present invention are possible without departing from the invention. Of course, the various features depicted in each of the Figures and the accompanying text may be combined together. Accordingly, it should be clearly understood that the present invention is not intended to be limited by the particular features specifically described and illustrated in the drawings, but the concept of the present invention is to be measured by the scope of the appended claims. It should be understood that various changes, substitutions, and alterations could be made

hereto without departing from the spirit and scope of the invention as described by the appended claims that follow.

[0031]   While embodiments and applications of this invention have been shown and described, it would be apparent to those skilled in the art having the benefit of this disclosure that many more modifications than mentioned above are possible without departing from the inventive concepts herein. The invention, therefore, is not to be restricted except in the spirit of the appended claims.